DOCUMENT RESUME

ED 133 141 SE 021 155

AUTHOR Smith, Gail P.
TITLE Forest Interpreter's Primer on Wildlife. A Reference for Forest Service, USDA Forest Interpreters.
INSTITUTION Forest Service (DOA), Washington, D.C.
PUB DATE Jun 75
NOTE 61p.; Photographs may not reproduce well

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Biology; *Conservation Education; *Higher Education; *Instructional Materials; *Natural Resources; Outdoor Education; *Secondary Education; *Wildlife Management; *Zoology

ABSTRACT

This guide was prepared for the use of Forest Service field-based interpreters of the management, protection, and use of forest and range resources and the associated human, cultural, and natural history found on these lands. It consists of basic forest and range wildlife information. Sections in the publication include: (1) What is Wildlife; (2) Basic Needs of Wildlife; (3) Properties of Fish and Wildlife Populations; (4) Uses of Wildlife; (5) Wildlife Management - A Brief Review; and (6) What of the Future? (RH)

**********
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
**********

ED133141

# Forest Interpreter's Primer on WILDLIFE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

A REFERENCE FOR FOREST SERVICE, USDA FOREST INTERPRETERS

SE 021 155

TT-52 (1680/2300)



U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Cover photo: American Bald Eagle
North Tongass National Forest,
Alaska. FS-522160

With the Nation on the verge of entering into full celebration of its Bicentennial in 1976, it is fitting and proper that the American Bald Eagle should adorn the cover of our wildlife primer

FOREWORD

This "Forest Interpreter's Primer on Wildlife" was specifically prepared for the use of Forest Service field-based interpreters of the management, protection, and use of forest and range resources and the associated human, cultural, and natural history found on these lands. It is the first in a series of six primers on the multiple use of forest and range resources planned for publication by the Visitor Information Service--the interpretive arm of the Forest Service. These primers will be "working and training tools"--special reference materials for forest interpreters--and are not necessarily designed to be popular publications.

Most Forest Service interpreters are temporary summer employees. They are experienced high school or college teachers of the natural sciences. However, few of them have had the opportunity to major in technical forestry. This primer, therefore, consists of basic forest and range wildlife information intended to supplement the forest interpreter's knowledge of the subject. While it will not make him or her an expert on forest and range wildlife management, its study will definitely broaden the interpreter's knowledge of the subject.

As the forest interpreter studies this primer, questions will arise that need answers. He or she is urged to consult with the local district ranger or National Forest wildlife biologist. We also invite the interpreter to further self-study by reading some of the publications listed in the back of this primer.

All photographs appearing in this publication are intentionally large-sized. Since habitat is a key to wildlife management, we consider it important that the reader get a better view of the natural habitat in which the wild animal is pictured. We believe the larger photographs help achieve this aim.

Suggestions for improvement of this publication and contributions to our "Did You Know" section are welcomed by the Forest Service.

ZANE G. SMITH, JR.
Director of Recreation Management
Forest Service, Washington, D.C.

## WHAT IS FOREST INTERPRETATION?

Forest interpretation is a communications program which offers a service to the visitor (usually a family on a vacation or holiday visit to forest, range, or its associated lands) through opportunities for on-the-ground guided or "do-it-yourself" learning experiences. Although forest interpretation is usually associated with outdoor recreation, it is much more than an exercise in the identification of the flora and fauna of the range and forest. It is designed to introduce the visitor to the natural resources as they really are, enabling him to explore, become better informed, and to draw his own conclusions about the management, protection, and use of the forest and range and the associated cultural, human, and natural history of the land.

It is hoped that through such an experience, the visitor will come to the self-realization that man and nature are closely interdependent and that the prudent use, protection, and management of natural resources is important and vital to all life on earth. We also hope that the visitor's exposure to the story behind the trees and range becomes a pleasant, exciting and memorable family learning experience in the great out-of-doors.

## WHAT IS A FOREST INTERPRETER?

He or she is a person who has a deep-seated compassion for the big and little things in the forest and on the range and understands their relationship to each other and to man. He or she likes and accepts people as they are. The interpreter also knows that to many people, the challenge of the forest is "what's behind the next tree, the next rock, the next bend in the trail, under that bush or over the next hill."

The interpreter is also aware that some people are totally at home in the woods while others are plagued by a sense of lurking danger. He knows that if, as part of the interpretive experience, he can stimulate the use of the visitor's five senses--seeing, touching, smelling, hearing, and tasting--that the visitor will probably leave with an enduring memory of his trip to the forest.

The interpreter also knows that visitor participation--be it physical or mental--is the true key to a meaningful interpretive experience for the visitor to the outdoors. It is for this reason that the interpreter endeavors to provide the visitor with the opportunity to participate in a series of well-designed interpretive experiences, hinged on discovery and "do-it-yourself," which lead the visitor to a feeling of self-confidence, a sense of accomplishment, satisfaction, enjoyment and finally to a self-realization of the basic truths which govern man's relation with nature.

# FOREST INTERPRETER'S PRIMER

# ON

# WILDLIFE

A reference for Forest Service, USDA Forest Interpreters

TABLE OF CONTENTS: PAGE


Introduction . . . . . 1

What is Wildlife? . . . . . 2

The Early Days . . . . . 3

Basic Needs of Wildlife . . . . . 7

Properties of Fish and Wildlife Populations . . . . 16

Uses of Wildlife . . . . . 27

Wildlife Management--A Brief Review . . . . . 29

What of the Future? . . . . . 46

Did You Know? . . . . . 46

Suggested Additional Reading . . . . . (Back Cover)



Prepared for the Forest Service by Gail P. Smith, Forestry Summer Intern from Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Produced under the direction of George Vitas, Leader, Visitor Information Service, Recreation Management Staff, with technical review by Donald D. Strode, Assistant Director, Wildlife Management Staff, Forest Service, USDA.



Washington, D.C.
June 1975

INTRODUCTION

We live in a rich country. Rich with the cultures of many other countries, which have blended to form the unique culture and sub-cultures we have today. Rich with people, of different races, different talents, and different desires. A spacious country rich with many beautiful and diverse landscapes, towns, farms, forests, marshes, estuarys, and oceans; and with each differing scene there is a varying association of animals.

The wildlife we have today is part of our inheritance and also a reflection on past use and planning. All wildlife species have different needs, in food, shelter, range, and climate. An animal will only inhabit the areas in which all its needs are met. Wildlife management is a relatively new science in which food, water, and protective cover is protected, developed or changed to meet the particular needs of wildlife and fish species.

Wildlife can be enjoyed almost anywhere. Sparrows in the city are as important as the hunted species such as deer and grouse and the protected species such as the bald eagle and California condor. Wildlife enhances the richness of our land, and wildlife management is an important tool in developing and perpetuating our wildlife resource for enjoyment by present and future generations.

## WHAT IS WILDLIFE?

Wildlife, like timber or agricultural crops, is an important and abundant resource. Any non-domesticated animal species and certain domesticated species gone wild can be considered wildlife; but more specifically, wildlife usually includes non-domesticated vertebrates, especially the mammals, birds, fish, and reptiles. Many of the higher invertebrates, such as the arthropods are also considered wildlife.

Wildlife species are further classified by use into three categories, the game, non-game, and threatened and endangered species. Game animals are defined by law and are generally valued for food, for particular products such as fur or feathers, and for the hunting and fishing opportunities they provide. These animals are divided into big game and small game. Big game animals are mainly the ungulates and large carnivores (also carnivourous fish such as tarpon and sharks), while small game are generally small birds, smaller mammals, and fish. Non-game species are those not hunted for sport. Examples of these species are the songbirds, predatory birds, and small rodents such as mice and voles. Protected animals

White-tailed buck, Pisgah National Forest, North Carolina. FS-397100

The deer is a hunted game animal widly distributed in the United States.

include those species which are protected by state or federal laws. Endangered species, because man and his activities have encroached on or destroyed their habitat, are in immediate danger of extinction. Threatened species are in the same danger but their position is not so acute. All animals perform an important function in a balanced ecosystem of nature.

THE EARLY DAYS

Wildlife is one of our country's renewable natural resources. However, this resource is not inexhaustible. It can be maintained, but its permanency depends on careful planning for protection and management of the wildlife species and most importantly for their habitats.

Female traill's fly catcher, Malheur National Forest, Oregon.
FS-375576

This songbird is an example of a non-game species. It cannot be legally hunted.

California condor. Largest U.S. bird. Los Angeles Zoo, California.
FS-520767

This bird is an example of an endangered species. It is stringently protected under the law. Only 50 of these birds remain.

Before The Days of Fish and Game Laws. FS-26915A

A perfectly legal bag of wild ducks taken in Missouri in the spring of 1913.

In many instances, our country has been reckless with this resource. For this reason, many of our wildlife species are now endangered, or are already extinct.

There are many factors which explain the neglect of wildlife in the past. People felt that the numbers of some species, such as the buffalo and the passenger pigeon, were so great that the animals could never be exterminated. In the late 18th century, it is

estimated that there were about 60 million buffalo and over 2 billion passenger pigeons. More animals were killed than were needed because often market hunters took only the choicest parts of the animals. Meat was also wasted by spoilage while waiting shipment to other parts of the country. Politics was another factor which influenced people.

The Federal Government condoned the shooting of millions of buffalo, encouraged settlement in the West, and established predator control programs. When the buffalo disappeared, the Indians, dependent on the buffalo, moved on. With predator control, the prairie was free for use by settlers for domestic crops and cattle. Politics was also a factor in the demise of the waterfowl population. State governments, in an effort to keep hunters happy, would not cooperate with other States located on waterfowl flyways in setting sound hunting regulations. Technology played a part in the reduction of wildlife, higher powered and more accurate guns and bows were designed and were used for hunting.

Predator control resulted in the killing of millions of predators with no permanent solution to the problem of attacks on livestock.

The most devastating problem for wildlife was the advance and encroachment of the human population and the resulting destruction of wildlife habitat. Potholes and marshes were drained, the prairie grass was replaced by domestic crops, forests were cut to provide farm space and houses, and the wildlife was removed and replaced by domestic animals. By the late 1800's, America's wildlife population had rapidly declined.

As the land became more settled, people began to realize that the wildlife habitat was shrinking and many species of wildlife were getting scarce. Conservationists, hunters, and professional foresters, concerned that many species were on the verge of extinction, seriously studied the present laws and made suggestions to institute more restrictive hunting seasons, new gun laws, and game-bag limits. Scientific studies of animals and their habitat were begun and the findings were used as a basis for changes. This was only the beginning. Conservation work was undertaken by the State and federal governments, forest related industries, and private landowners in reforestation, land rehabilitation, and sound farming procedures. People observed the increase in wildlife numbers on rehabilitated land, and realized its dependence on a suitable habitat.

Stringent protective laws, along with well planned habitat management, has helped redeem many wildlife populations, such as buffalo and pronghorn antelope, however, many species are still threatened. Wise use of private and public lands, a better understanding of wildlife and its needs, and environmental education will help save and

perpetuate the nation's wildlife for the generations to come.

## BASIC NEEDS OF WILDLIFE

Wildlife, like people, have a few basic requirements in order to survive. Among these are food, water, cover, and adequate living space. To grow and reproduce, they of course need a mate, and in some species, freedom from disturbances.

A habitat is the place where a given animal or plant naturally lives and thrives. Every animal has different needs which are met by the many different forest, grassland, and other vegetative cover types in our country. A wildlife habitat incorporates the total environmental conditions of a certain area occupied by wildlife. Conditions include food, water, cover, a degree of solitude, and people. Of course, these conditions must be favorable for a particular species if it is to thrive in the area. And more than favorable conditions, these most important needs must be properly interspersed within the range of the animal.

Shiras Moose, Hoodoo Lake, Lolo National Forest, Montana.
FS-314076

An ideal environment for moose. A secluded place in which to breed and thrive.

Habitat quality for a particular species is generally determined by the abundance and interspersion of food, water, and cover. These must occur in the proper condition and location to support the wildlife on a sustained basis. Food includes the critical or usual dietary needs, and special needs. These foods must be nutritious and available during each season of the year. Nuts and seeds for gray squirrels is a critical need. Many species also have special needs besides their regular diet; for example, many species of birds need gravel to grind the food in their gizzards. Herbivores may require a supply of salt along with their regular diet.

Wildlife food must be of good quality, be in sufficient quantity, and must also be available to the animal. The quality of food is very important. For example, there may be enough winter food within reach of deer but if the food is deficient in essential nutrients (especially large amounts of calcium, phosphorous, carbon, hydrogen, oxygen, nitrogen, and potassium), the deer may still starve, even with a full stomach. This situation has occurred on lands overpopulated with deer. Plants do not contain the same amount of a mineral during all seasons. In winter, many species of plants often are low on a particular nutrient like phosphorous while high in another, like molybdenum, it is, therefore, important that many varieties of plants be available. Predators feeding on plant-eating animals get their required nutrients from the minerals stored in cells of the herbivores' flesh. There is a noticeable link of soil quality to wildlife size. If the soil is rich in minerals, the plants are rich in minerals. Animals feeding on these plants are healthier, bigger, and produce more offsprings. The carnivores, feeding on these animals, are generally larger and more healthy.

A sufficient quantity of food depends on many things. One factor which is significant is that of population. The season of year is also very influential (except in the south, where population size limits the quantity of food per individual). There is generally less food in the winter for animals. A sufficient quantity of food then must be judged by how much food will be at hand for the number of animals present in the winter. There may be nutritious food available, but if there is not enough, the animals may die of starvation. Weather conditions can effect both quality and quantity of food.

Extreme conditions like drought or flood will slow or destroy growth and in winter there may be a critical shortage of food. Physical factors like fire or timber harvesting can increase or decrease the food supply for animals depending upon the species involved.

Quality and quantity of food must be related to its availability. Even if there is lots of quality food, if it is out of reach of the animals, they may still starve. This is usually the case with populations which will not move out of their home range. For example,

A hungry doe. Cheyenne Park, Colorado. FS-395646

Thriving wildlife must have plenty of nourishing food that is available. This overbrowsed deer range provides slim pickings for this deer who must stand on her hind feet to reach a meager mouthful.

with deer in winter, there may be food present but if it is above their reach, they cannot use it. Deer will not move from familiar territory in search of food. Other animals like the snowy owl, however, will move to find food. This bird moves south when the mainstay of its diet, the lemming, a northern species, dies off. For a habitat to be determined productive, there must be enough food of high quality that is available for the species and numbers of animals present.

Food is essential for life but water is even more important to many wildlife species. A person can live over 3 weeks without food but can live without water little more than 3 days. Water is needed to clean wastes from the system, to carry nutrients, hormones, respiratory gases, and enzymes with other cells in the blood stream; to help cool the body as sweat, and for many other internal functions. Arid lands can be made much more productive for some plants and wildlife, if they are irrigated or provided with water holes.

Water is used by wildlife in three ways--for drinking, protection, or for a habitat. The water should be clear and free of any pollutants. Silt and peat are as much pollutants as fertilizers, soaps, and effluents from factories. It is very important then to protect

Chippewa National Forest, Minnesota. FS-517666

Waterfowl must have water. Here biologists have blasted a pothole out of a bog as part of their waterfowl habitat improvement work. These holes, about 30 feet in diameter and 5 feet deep, fill up with water by spring.

the soil from erosion on the mountains from which streams, rivers, and lakes originate. It is also important to try to minimize all the additives as the water comes down to the piedmont and plains.

Open drinking water is needed by most animals. Exceptions are some of the desert dwelling birds, reptiles, and rodents. However, even though surface water isn't available, these animals still consume

water either directly from water-storing plants like cacti, from the body fluids of other animals, or they manufacture water inside their own bodies. Penguins can utilize both salt and fresh water. It is important for water sources to be surrounded by vegetation; this helps keep the water cool and provides protection as animals come to drink. In streams, vegetation also provides bank stabilization, keeps debris from getting into the water and provides insects for aquatic animal food.

Many animals use water for protection. Water can protect animals from excessive heat, and will even slow or stop ground and surface fires. Many animals will use water to evade predators. Key deer and other hoofed mammals will take to water to escape pumas, hunting dogs, or wolves. Also amphibious species like otters, muskrats, and beavers head for water in case of danger, as well as for other needs. A good habitat will have year-round sources of water, frequently interspersed with other land forms in the area.

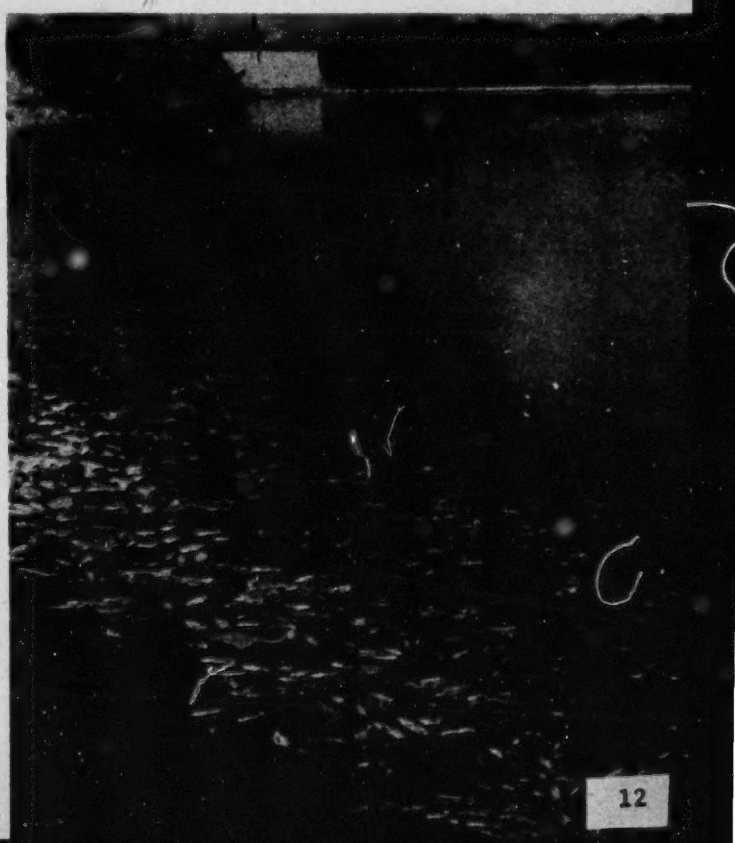
Water can also provide a quality habitat. The marshlands, estuaries, and sea coasts are some of the most commercially important habitats we have, producing huge quantities of fish, lobsters, oysters, clams, shrimp, and crabs. Fish, of course, are an important resource in both fresh and salt water habitats. Many fur bearers and game animals must have a water habitat to survive. Beaver and muskrat, which are valuable for fur, are fully adapted to water. They get their food from aquatic plants, and build their homes in the water. Mink, also a prized fur bearer, prey on beaver and muskrat and hunt along streams and rivers. The moose, a big game species, also feeds on water plants and uses water for protection. Waterfowl, another game species, must have water to survive. Many of their needs for food, cover, and territory are met only by a water habitat. The draining of potholes, lakes, and marshes is the main problem contributing to the decline in their numbers.

Water based habitats are some of the most complex habitats. Water holds thousands of fragile micro-organisms which are the food for shellfish and tiny crustaceans which, in turn, feed fish, birds, and man. Since water habitats are based on such delicate organisms, even small changes such as pollution, or vegetation removal can cause severe damage, resulting in much loss. Commercially, these losses can result in less seafood in poorer recreation with decline in fish and birds, and aestetically, it can be the loss of a beautiful landscape complete with its unique and uniquely bonded wildlife.

Food, water, and cover are fundamental wildlife needs. Since most wild species don't build houses, natural cover is their substitute. The cover used by wildlife is basically for shelter or protection from predators. Cover is a general term used to describe vegetation and topography. Vegetative cover is divided into three cagetories:

the overstory of trees, the midstory composed mainly of large shrubs and small trees, and the understory that includes small shrubs, grasses, and forbs.

Animals need cover for many different, although, similar purposes. Brood cover such as grasses and forbs, is needed to give shelter and protection to young game birds, like quail, turkey, and grouse. Escape cover can be shrubby or herbaceous, a hollow tree, rock crevices, water, burrows or anything that provides the animal a means of getting away from predators. Nesting cover vegetation is required by birds or animals to rear their young. Examples, are tree dens for squirrels, burrows for badgers or mice, or grassy patches near openings for quail, turkey, grouse and rabbits. Roosting cover is required by birds. It can be anything from conifers for owls to idle fields or sparse timberland for quail. Farms with odd areas planted in trees can provide excellent shelter and protection cover for wildlife. Some animals also have particular needs for cover in winter, to protect and shelter them as they hibernate. Wintering cover is all the cover needed by some wildlife to winter over. It can vary from trees with squirrel dens to brush cover for quail, and rock outcrops for bear.



Polluted Ohio stream. Photo by Ohio County Fish and Game Association. FS-425568

A good fish habitat calls for unpolluted water. Here, sugar beet factory wastes, dumped into this stream proved fatal to its fish population.

The quantity and quality of food, water, and cover are used to determine the quality of the habitat. If an area has sufficient quality food, water, and cover distributed over the land in a way favorable to the animal, it is a good habitat for that animal.

People, and some of our wildlife, have a psychological need for privacy and elbow room, along with their physical needs for food, water, and cover. This is demonstrated in humans by the desire to get away--to leave cities, and business behind; to be out in the country or in the forest where there is beauty and space to relax the eyes, and quietness to relax the mind. Animals demonstrate this desire by establishing and defending a certain area, called a territory, from others of its species.

Territories are used for more then just this psychological need. Some or all of an animal's physical needs for life can be contained and defended in this area. Avian species have been found to defend five different types of territories. There are some species which choose and defend an entire mating, feeding, and breeding area. Other species have only the mating and nesting sites in their territory. A third type of territory includes just the mating area. A fourth type of territory is used by species which protect nesting sites only. And other species will establish territories which encompass non-breeding areas such as feeding and roosting sites.

Many species of fish commonly exhibit territorial behavior. These include sunfish, bass, stickelbacks, and minnows. Male black bass and sunfish will defend their nests by rushing toward an intruder.

With mammals, it is hard to observe territoriality because so many species are nocturnal or burrowing. Wolves have been seen to raise young together in one den. In a study of spotted skunks, it was found that one den was the corporate possession of the local skunk population. It has been hypothesized that social dominance hierarchies of some mammals, like herd animals, serves the function filled for others by territoriality. It is also known that herds, packs, and other groups will establish a territory shared and protected by every individual in the group. However, there are some mammals which are decisively territorial; examples are squirrels, beaver, female chipmunks, bull sea lions, muskrat, rabbits, and mice. There are two types of territoriality here: defense of nesting sites as shown by beaver and muskrat, and the defense of food caches as in the red squirrel which may store and defend several bushels of green pine cones.

The side benefits of this behavior for all species of wildlife, birds, fish, and mammals are many. For birds expecially, since they most often exhibit this behavior, territorialism provides an adequate supply of food (though territories are smaller when food is abundant).

It also provides a mechanism for establishing and maintaining the pairing bond; regulation of population density; reduction of interference with breeding activities; reduction of predation losses; and possible reduction from infectious disease transmission. Since territory is a need for many species, it is also included as a part of a habitat, the general environment in which an organism lives; its natural home.

An animal's home range includes all the area over which it travels while engaged in its usual activities. The whole home range is not all defended, although part of it may be. Herbivores, because their food requirements are met in a smaller area, have a smaller home range then the carnivores. If the soil is of poor quality, the home range for both herbivore and carnivore are extended to a point where sufficient food is included.

Cougar.
Boise National Forest, Idaho. FS-521797

A wild animal must have room to roam. This mountain lion has a "home range" of 30 to 35 miles and may eat 3 deer per month.

White-tailed deer. Oklahoma. FS-246931

To reproduce, all higher organisms must have a mate. The father of these unusual triplets is not seen here, but the fact that this doe gave birth to triplets is an indication that she resides in an excellent deer habitat.

Of course, to reproduce, all higher organisms need a mate. However, there are also some wildlife species which once their numbers get below a certain number, will never be able to rebuild the population, and the species becomes extinct. This was one of the problems contributing to the extinction of the passenger pigeon, and now possibly facing the whooping crane. The passenger pigeon was one of many species which, in nature, are dependent upon a social stimulus for reproduction.

Disturbance, whether by people or physical factors, has a large effect on how an animal lives or reproduces. California condors will abandon their nest and eggs for hours, exposing their young or eggs to the weather and to hunger, which can cause death, if humans approach to within 1/2 mile of their nest. Some birds like grouse or pheasants will rebuild their nest and hatch a new brood if their

nest is disturbed by machines or predators, but only early in the year. Some animals which take a mate for life, usually will not mate again if the mate is killed. This is the case with wild geese and ravens. Weather and other physical factors like fire, floods, or drought can interrupt or terminate breeding and rearing of young. It is, therefore, important that a habitat be free from an over-abundance of disturbances so that living and reproducing can be maximized.

To summarize, an animal needs a good habitat, a home range, a mate, and favorable social conditions for mating and some freedom from disturbances.

## PROPERTIES OF POPULATIONS

A living organism can be a very fragile thing. Animals and whole populations can only live under the right conditions. This concept of tolerance is important in the study of population. In the physical and biotic environment of any organism are factors which can restrict growth, interfere with reproductive success, and even cause death. They are called limiting factors. For every organism there is a specific tolerance range for any essential environmental factor below or above which the organism's activity is adversely affected.

Animals have limits to their tolerance of environmental conditions, relations with their own species, and relations between species. As to environmental conditions, all wildlife species by a process of selection, have become adapted to special climatic and other conditions. Adaptions to normal conditions within a species range have developed genetically, and when from time to time new genes are introduced, the environmental limitations of the species test these genes. If the genes are beneficial to survival, they may be spread by reproduction. If not, the animal usually will die before reproduction and the population is protected from a detrimental gene. This genetic selection process is called natural selection; because a species has limiting factors, only the strong and best equiped will survive.

Every individual also has a limit in its tolerance to other individuals of its own species. Here, abundance of food, water, and cover are the limiting factors. Because individuals of the same species compete with one another for basic needs, the number of individuals in one area is dependent upon the amount of food, water, and cover available. If there is a lot of food, water, and cover available, there will be more individuals than in an area where essential habitat is limited. This is the idea of carrying capacity. Because of competition for basic needs within a species, an area can only provide for a limited number.

Between species there are also ranges of tolerance. There can be too many predators or too few, and even more important, too many herbivores. Herbivores do, by overgrazing, affect the quality of the habitat. There is also a form of carrying capacity defined as the saturation point for [illegible] species and their environment.

There are three basic types of movements among vertebrates: (1) dispersal of the young, (2) mass emigration, and (3) migration. These movements serve many purposes among individuals, families, and the whole species. An individual, by moving, may be benefited by more favorable food supplies, breeding sites, climatic conditions, or just more living space. The species may benefit if movements result in the establishment of a population in a habitat which the species did not originally inhabit. Then, if the original habitat is destroyed, the species will not become extinct. The species is also benefited by an increased gene pool upon which natural selection can operate, increasing the genetic and physical strength of the whole species.

Dispersal is a phenomenon which occurs mostly in the young of any species of birds and mammals. Once the young animals are able to care for themselves, they are driven out by their parents. These animals then disperse to other areas, which frequently are less suitable habitats, where they sustain heavy mortality from predators and accidents. However, a high mortality rate is needed to keep the population from expanding beyond its range's capability to supply the essential habitat. Dispersal of young seems to be an important element in controlling population density. The dispersal of young eagles has served to be adaptive as well as to regulate density. Young eagles in Florida have been found to go north where their species originated.

Mass emigration is a common phenomenon which arises from an inbalance between the size of the population and its habitat. If the conditions have been favorable for a species (good weather, abundant food, and minimal depletion from predators and accidents), then the local population will expand rapidly. When something affects the favorable conditions, like a drought, the food supply is suddenly reduced. Under these circumstances, the population must either reduce its activity, hibernate, or emigrate to avoid starvation. There are numerous examples of these mass emigrations. The snowy owl will emigrate from Canada southward when its primary prey, the lemming, undergoes a population crash. The squirrel is another species which will move if there is a poor year in hard mast production. Emigrations of grosbeaks and crossbills into the northern States from the Canadian taiga result from pine seed crop failure. Crossbills are very dependent on an adequate seed supply, basing the time and place of nesting on availability of seeds.

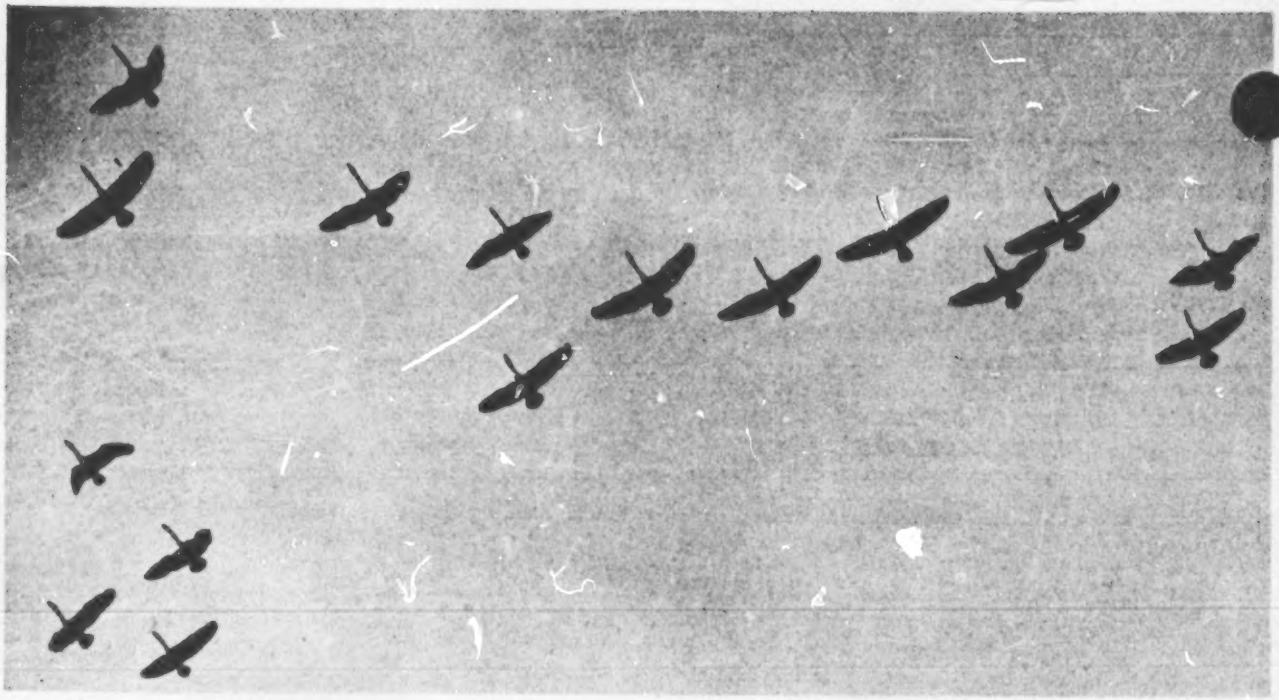
The third basic type of population movement is the seasonal migration.

Grey squirrel, Cleveland National Forest, California. FS-164442

Sudden drastic reductions in food supply, brought on by catastrophies such as severe droughts, will cause some birds and mammals to emigrate from the stricken area in a mass movement of the populations to escape starvation. The squirrel is one species that will migrate from its home territory if there is a very poor year in hard mast food production.

These can be either latitudinal or altitudinal. They are quite a common occurrence in birds, mammals, and fish. Hunters have counted on these regular migrations for thousands of years for food, hides and sport.

Latitudinal migrations can best be exemplified by the familiar waterfowl migrations. In the fall, the waterfowl leave their northern breeding grounds to winter over in the south, where resident bird density is low and food supplies such as insects, fruits, and seeds are more readily available and it is warmer than in the northern latitudes. During the flight and at stopping places, territorialism seems much more relaxed and many different species fly, feed, and roost together in huge flocks. When spring comes, the length of daylight stimulates mechanisms which causes some birds to fly northward. These northern habitats have a higher carrying capacity for migrants and the future broods. Also, these far northern habitats, like Alaska, have longer daylight hours which afford more feeding time for young. It has been hypothesized that the access to two different habitats (winter and summer) will provide a more balanced supply of vitamins and minerals. A few other well-known species



Wild geese migrate, Shawnee National Forest, Illinois. FS-374906

The flight of the Canada goose north to south in fall and south to north in spring exemphlifies latitudinal migration. It is believed that this movement gives access to two different habitats (winter and summer) which provide a more balanced supply of vitamins and minerals.

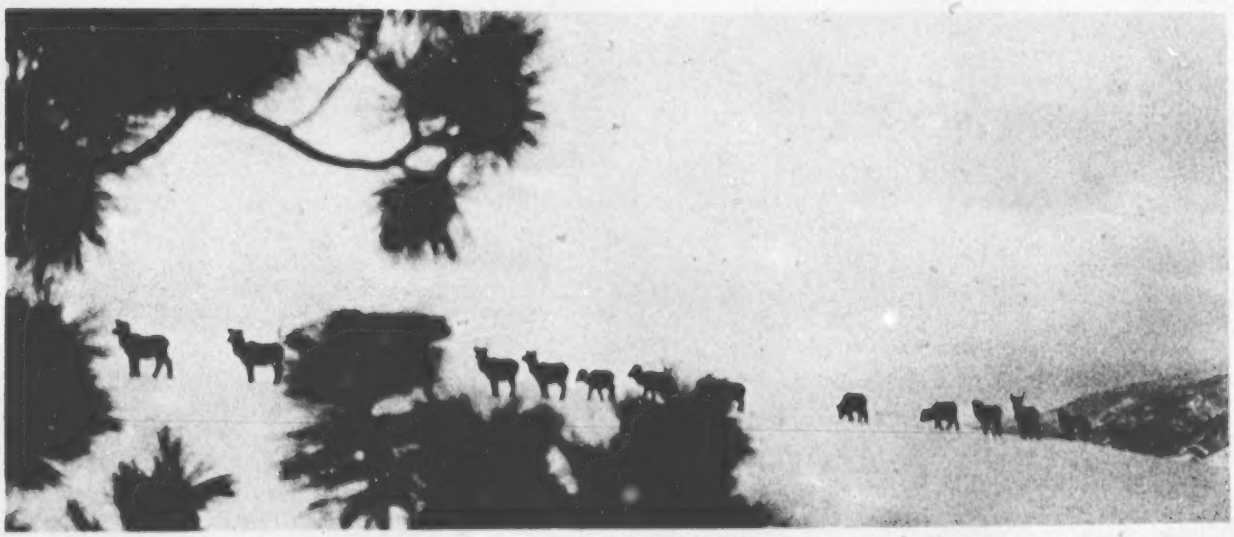
which migrate in this way are the caribou, grey whales, and the Kirtland's warbler.

Altitudinal migrations are also made primarily to improve food supplies and weather conditions. A good example of this type of migratory behavior is with the elk herds in Wyoming. When the first snows cover their food supply in the fall, the elk will move down the mountains to feed in lower, more protected areas. Once spring has melted the snow, and the forage is available, the elk will move back up to their summer range in the cooler elevations. These migrations don't cover near the distance that latitudinal migrations cover, but the result is the same. Many other hoofed mammals, such as the Rocky Mountain bighorn sheep and wild horses, migrate this way. The pine grosbeak, blackcapped rosy finch and the grey-headed junco also winter at lower altitudes. However, this pattern is reversed for the blue grouse. This species descends into the valleys during breeding season, and retreats into the higher mountains at the end of the summer, where it winters over.

Not only are populations always on the move, but their numbers are always changing. The study of population dynamics is very important for wildlife management. On the basis of the biotic potential, longevity, and mortality rate, a decision of hunter harvest can be made. It has been found that environmental factors account for the loss of between 20 percent and 70 percent of the young born in one year. Studies of the factors which can cause death or a decline in biotic potential, have helped threatened or endangered species when ways were found to reduce or eliminate these factors.

Biotic potential can be defined as the theoretical maximum population growth rate of a species, or the inherent ability of an organism to multiply in the absence of external controlling factors. The birth rate depends on the number of live fertile offspring produced at each reproduction, the frequency of reproduction, the sex ratio, the minimum and maximum breeding age of the individual, the mating habits, and the population density.

Clutch size in birds, which is primarily determined by heredity, varies greatly with the species. One-egg clutches were characteristics of the now extinct great Auk and the passenger pigeon.



Travelling elk herd, Bitterroot National Forest, Montana. FS-276665

Elk practice altitudinal migration, primarily to improve food supplies and weather conditions.

Black bear in daisy covered meadow. Wenatchee National Forest, Washington. FS-519753.

Generally, the larger species of mammals, such as this bear, have smaller litters. For example, white-tailed deer, on good deer habitat, will average 1.7 fawns per doe season after the first season; on a poor deer range, the average is less than one fawn per doe.

Twelve-egg nest of Ruffed grouse. Cherokee National Forest, Tennessee. FS-486268

Clutch size in birds may vary from two-egg nests, such as loons and eagles, to up to 20 eggs for the Hungarian partridge hen. Clutch size is believed to be determined by the maximum number of young a species can adequately nourish.

Loons, eagles, great horned owls and whippoorwills lay two-egg clutches; while thrushes, warblers, sparrows, and blackbirds lay four to six eggs per clutch; eight to fifteen-egg clutches are exemplified by ducks, pheasents, quail and grouse. A Hungarian partridge hen may produce twenty eggs. Clutch size probably is determined by the maximum number of young a species can adequately nourish.

Geographic variation in clutch size has been observed. It seems that the larger clutches laid in the more northern latitudes are correlated with the number of daylight hours (up to 24 in the far north) in which food may be gathered for the young. For example, the number of broods reared by barn owls during the breeding season, appears dependent on food availability; several broods may be reared when mouse population peak, but the owl may not nest at all when mice are scarce.

It is hard to arrive at a comprehensive average biotic poential for mammals because their litters are usually well hidden. But numbers can be approximated by counting the embryos in the uteruses of collected specimens, or the placental scars if the animals are taken after the breeding season. Generally, the larger species of mammals have smaller litters. The number of young per litter is limited by the size of the uterus and the number of the female's mammary glands. The number of young will also vary with the amount of food available, as with birds. A white-tailed deer population inhabiting very productive land will average 1.7 fawns per doe a season after the first season, while a deer population on a poorer range will average less than 1 fawn per doe. Under very poor conditions, a doe may not give birth at all and the embryos will be ingested by her system.

There are other conditions which will limit both litter and clutch sizes. If there is a condition of overpopulation, reproduction is hampered by fighting, interference with mating, and generally stressful conditions. Weather also has an influence on litter size. The litters seem to get larger from south to north in small rodents, possibly an adaption to compensate for the severe winter climate farther north. However, this trend doesn't seem to be true for other mammals.

Fish and amphibians have a fantastic biotic potential, producing thousands of eggs in one season. This great production is an adaption for the heavy losses incurred by the hatched but undeveloped young.

Longevity is a computation of approximate life expectancy, and it enters into population dynamics. If an animal can live the expected number of years, more young will be produced.

Animals in their natural habitat seldom die from old age, succumbing most often to one or a combination of adverse physical and biotic factors, known as environmental resistance. Environmental resistance can be broken down into three categories: the decimating factors, welfare factors, and environmental factors. Decimating factors directly influence population size. Hunting, poaching, predation, starvation, diseases, parasites, and accidents are examples of the decimating factors of environmental resistance. Welfare factors

are those which affect general health and biotic potential which lower a population's resistance to decimating factors. Examples of this type of environmental resistance would be limited or polluted supplies of food, water, and cover. Environmental factors alter the habitat, thus affecting population size. Examples of this are weather, drainage, and cultivation. A high death rate is essential to conterbalance an equally high biotic potential, and to keep the population within the carrying capacity of its range.

Some species' populations rise and fall over time in more or less defined cycles. Using this behavior as a basis, populations can be separated into three categories, exhibiting either stable, erruptive, or cyclic behavior.

Stable populations are characterized by small rises and falls in numbers which occur at completely random, but short time periods. Over a long period of time, the population's numbers appear almost constant. Most wildlife populations become stable once they have reached the carrying capacity of their habitat. Bobwhite quail populations are representative of species with a stable population. The size of this species' population will fluctuate seasonally.

Cottontail rabbit emerges from his hiding place under log. Colorado. FS-425012

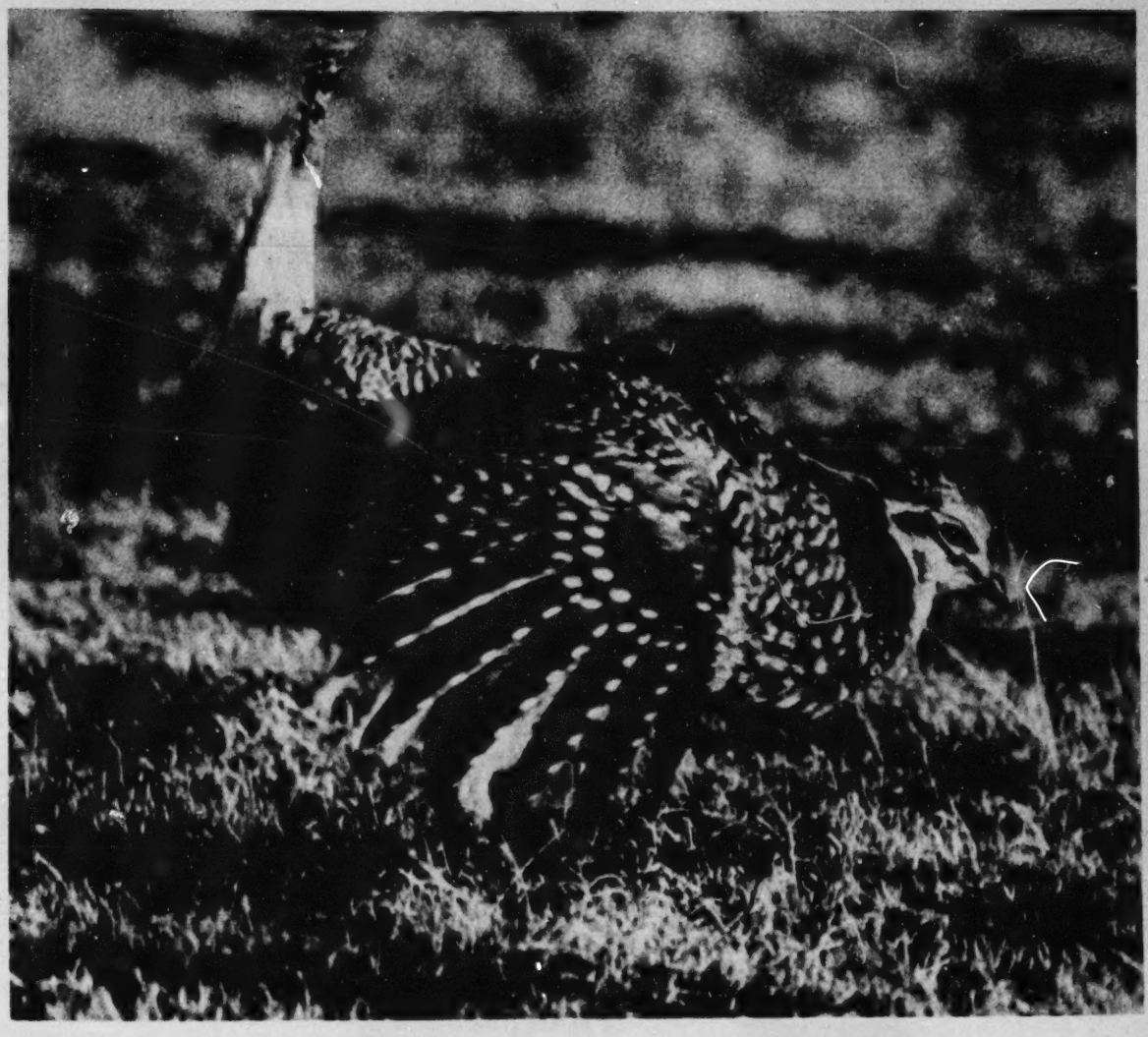
Animals in their natural habitat seldom die of old age. Nature has a way of balancing the population with the carrying capacity of the habitat in which animals dwell.

In the late spring and summer, when there is food available, the population peaks with the season's young. After winter, the population is at its low ebb. Factors such as disease, predation, climate, cover, and food availability may vary, resulting in slight upward or downward shifts in population. Even intrapopulational shifts in age and sex ratios may affect a population level.

After fluctuating mildly for many years, some populations, such as those of deer or mice, may suddenly increase sharply or erupt, after which they crash to a very low level. Eruptions are highly erratic and usually unpredictable. In some cases, they occur when there is an unusually favorable climate for reproduction, or an unusually abundant (though temporary) food supply. In the dry parts of the southwestern United States, a year of unusually abundant rainfall may result in eruptions of jackrabbits, quail, and Chukar partridges because of the temporarily increased vegetational foods. When rainfall reverts back to normal, food supplies diminish and populations subside to their original levels.

Cyclic populations show sharp increases, followed by crashes, at rather regular intervals. To some degree, the population peaks and troughs can be predetermined. The two cyclic intervals most thoroughly studied occur at 3 to 4-year intervals, exemplified by the lemming; or at 10-year intervals, represented by the snowshoe hare, lynx, and grouse. It is the brown lemming of the North American tundra biome, which has a characteristic 3 to 4-year cycle. The lemming forms the principle food of the snowy owl, promarine jaegar (a predatory bird), arctic fox, and red fox. Apparently these predators have few alternative prey species on which to feed, and therefore, their populations vary with that of their lemming prey. Many of these predators starve during the winters of population troughs. Snowy owls, though large numbers starve, have, during these crashes, emigrated to the United States, some moving as far south as North Carolina. The reason for the crashes is a lack of cover. When the lemming population peaks, they overgraze the vegetation which served as a protective cover. During the spring's snow melt, the lemmings were vulnerable to predation and their numbers were drastically reduced. There are other species in which this cycle has been observed. These are the northern shrike, red-tailed hawk, meadow vole, martin, and sockeye salmon.

The 10-year cycle is not well understood. It is characteristic of the snowshoe hare, which inhabits the northern coniferous forests or taiga, and has been seen in muskrats in Iowa, ruffed grouse, sharp-tailed grouse, willow ptarmigan, and also quail, partridges, pheasents (in the northern portions of their range), and northern grouse. The Canada lynx, which preys primarily on the snowshoe hare, has a 10-year cycle that lags just behind that of the hare.



Sharp-tailed grouse. S. Dakota. FS-518132. Some wildlife species have a tendency to experience cyclic population changes--sharp increases followed by crashes at rather regular intervals. The sharp-tailed grouse tends to follow a 10-year cycle.

In studies of populations that are terribly overcrowed, a reaction called "shock disease" is found. It has been found that shock disease is responsible for the cyclic phenomenon in snowshoe hares. Other recent studies have proved shock disease may be a big reason for the cyclic behavior of other species' populations. The theory is that when populations peak, the increased stress caused by fighting and other physical contacts, in addition to the impaired nutritional value of marginal food supplies, and the greater energy expanded in searching for food and cover, results in stimulation of the pituitary gland by way of neural pathways and the hypothalmus.

The pituitary is stimulated to produce ACTH (adreno-corticotrophic hormone) which, in turn, causes the adrenal gland to increase its secretion of cortins. These hormones then cause a reduction of the reproductive function. Eventually, the pituitary-adrenal system becomes exhausted and death ensues.

Other theories have been put forward to explain the cause of 9 to 10-year cycle. They include variations in weather, fluctuations in solar radiation, depletion of food supply, disease, and changes in the nutrient levels of plant foods. It may be that several of these in combination are responsible for the cycles. As yet, however, many of the underlying reasons remain unexplained.

## USES OF WILDLIFE

Wildlife is important because it can be enjoyed in so many ways. Consumptive use can diminish population size, and so is a method used to manage populations. It will also bring returns of food, furs, and other commercial products. Hunting, fishing, and trapping are a much enjoyed form of recreation. The income from hunting and fishing licenses supports fish and wildlife improvements in most States.

Many critics of hunting are concerned with the motivation of the hunter and the conduct of the hunt. In a recent study of the subject, nearly half of the hunters said they would be satisfied with the hunt even if they did not kill any game, and about four-fifths said that much of the pleasure of hunting is the result of experiencing the wonders of nature first hand.

The State fish and game agencies and federal agencies have studied hunting techniques and the species being hunted and have established laws to permit the harvest of surplus animals by hunters.

Fishing is a well liked, consumptive form of recreation; and is also big business. Countries all over the world have fleets of fishing boats for the commercially important ocean species like herring, sardines, and tuna. Many people have capitalized on the ocean loving sport fisherman, using private fishing boats and heavy equipment for species like tuna and sailfish. Fresh, cold water fishing for species such as salmon and trout is big sport; and good eating. These species, however, are among the least tolerant of water pollution. And as man's activities increase, the job of maintaining water quality becomes more difficult. Salmon, which are anadromous fish (live in salt water but come to fresh water to spawn), also need their particular nursery streams free from obstacles so they may spawn. Fresh warm water fish, like bass and perch, are also well liked sport fishes.

Wild turkey hen and eight trailing 2-week old baby turkeys. Kaibab National Forest, Arizona. FS-476624

Just the sight of the shy wild turkey is treat enough for most outdoor enthusiasts.

Fishing near the Camp 7 campground. Hiawatha National Forest, Michigan. FS-502746

The looks on the faces of this father and daughter say, "Fishing is fun!" Fishing for millions is a sport but for commercial fishermen it can be a big business.

Trapping is still done although many fur bearers are now raised in commercial fur farms. Here the animals are bred to produce special favored colors of fur.

Research is the last main consumptive use of wildlife. Studies of eating habits, vitamin needs, pollution sensitivity and disease of wildlife species must be made to improve wildlife habitat and protect people and pets from sickness.

The State fish and game agencies develop laws for the protection of both people and wildlife, allowing only the surplus to be taken. They also enforce the laws and patrol areas for poachers.

Non-consumptive use of wildlife is just as important as the comsumptive uses. Millions of people enjoy photographing wildlife, or observing and studying birds and animals, as a part of their camping, hiking, picknicking, or other forms of outdoor experience. Wildlife can also be used as an environmental barometer. By observing the health and size of range of certain very sensitive species, the quality of the habitat, as to basic needs and also amount and type of pollutants, can be monitored. Some aquatic insects, for example, only inhabit polluted waters.

WILDLIFE MANAGEMENT - A BRIEF REVIEW

A forest provides five main renewable natural resources: timber, water, forage, recreation, and wildlife. Each of these resources are very much dependent upon the others; any change in one resource or its management affects the rest. Science has been successfully used to manage some of these resources for maximum benefits without destroying the supply and with consideration for the other resources.

Wildlife management is a new science. It makes use of the practical application of scientific and technical principles to wildlife populations and habitats so as to maintain such populations. This definition includes the narrower concept of game management, or specific attention to game species for recreational and commercial use. The objective is to restore, maintain, and increase wildlife populations.

Wildlife species are so dependent on their habitat that any change in its features will affect the wildlife; for better or worse. The newest concept in wildlife management is that of habitat management--to restore a habitat so a species may be reintroduced or to maximize the carrying capacity for an already established species.

Because there are so many species of wildlife with different needs

and uses, it may be necessary to choose a few species to feature on a piece of land and then manage the habitat specifically for them. The selection of a species to feature should be based on four factors: (1) habitat capability, determined by the capacity of the land to produce food and cover within the home range requirement of the species, either naturally or with intensified management; (2) compatibility with other forest resources, or how this choice will effect production of other resources, and the maintainance of water quality

Visitors on bank of Madison River watch bull elk feeding. Yellowstone National Park, Wyoming. FS-496943.

Many millions of people enjoy photographing, observing, or studying birds and animals as part of their outdoor recreation experience.

standards, and a consideration of cost, benefits, management zones and uniqueness (possibly a threatened or endangered species), (3) public interest or needs, the impact of habitat management on the public (like smoke resulting from prescribed burning for quail, aesthetic impacts of clearcuts, or mosquitoes resulting from brood areas for ducks); and (4) public involvement should be considered, it is important for the people and organizations of the area to have an input in a decision.

Once the species are chosen, the habitat should be managed to accomodate the maximum beneficial number of these species. It must include nutritious food available all seasons of the year, suitable cover for the various behavioral and physiological demands of the animals, and a favorable interspersion of the food and cover within the ranges of the animals. The objective for habitat improvement is met when the food and cover supports this maximum population without waste, without unduly suppressing other necessary habitat features, or without sacrifice of other multiple-use objectives. Once the objective is reached, maintenance is usually required.

Habitats may be improved, to support more animals, either directly or indirectly, depending on the need of the animal, the money available for improvement.

Direct improvements are land treatment measures or structures installed to benefit game, like constructing water devices in the dry country, making and placing den boxes or nest boxes for squirrels and ducks, placing boulders in a stream for fish or anything that is done by man to improve the food, water, and cover. Direct habitat improvement is usually costly. It is justified when: (1) the planned direct improvement on a small area will make a larger area of habitat usable or substantially better, (2) it is the only way to provide a missing essential habitat factor, or (3) it is needed to restore a habitat damaged by man's actions or by catastrophic weather conditions, and when natural restorat will not result within a reasonable period of time.

Indirect improvement employs manipulation of natural forces in the environment to achieve the same results as direct improvement. The use of natural tools is often a more effective and practical way of management. Furthermore, it can have an impact over a larger area. An example of indirect improvement would be increasing food and cover for some species by timber harvesting practices, this removes the overstory and allows supportive shrubs and grasses to grow more freely.

In making successful improvements on land and water, it is very important that the measures taken for habitat improvement are in harmony with the entire biotic community and ecosystem. Ecological

Logging road on Ottawa National Forest sale area has voluntarily sodded itself in 3 years. FS-481610.

This edge effect created by logging permits wildlife to move safely about. To improve the edible quality of this habitat, wildlife managers later mowed and seeded it to clover. In this case, logging resulted in a bonus benefit for wildlife.

needs must be considered in every practice because of the complex interrelationship between organisms.

A forest is always growing and changing, so in order to maintain an improved wildlife habitat for specific animals, work must still be done periodically. In maintaining the habitat, it is very important to understand the needs of the animal species and to time maintenance treatments to these needs. These treatments must also be compatable with other multiple use management and their maintenance schedules. Three time factors are important here: (1) the interval of time between treatments in the same unit, (2) the scheduling of treatments in relation to stand age, and (3) the sequence of treatments.

Thinned western larch stand of trees. Flathead National Forest, Montana. FS-522067.

Big game browse production increased dramatically in only 2 years after this stand was thinned.

Important to the interval of time between like treatments, is rotation--the time in years between regeneration and final harvest of a stand. Rotation will, in the long run, determine the proportions of an area occupied by stands of sapling, pole and sawtimber sized trees. Thus, rotations govern the area devoted to fruit and browse plants, pole stands, and older mast-producing stands (stands dominated by nut-producing trees). With even-age management (units of trees of the same age), choice of rotation will largely govern the relative success of wildlife management programs. Also important to this factor is the cutting period, or the interval between silvicultural treatments, which will determine the period that understory growth is renewed and overstory crowns are released. And the prescribed burning cycle can largely determine the kind and amount of forbs, legumes and shrubs in the understory.

The second time factor, scheduling of silvicultural treatments like weeding, cleaning, and thinning of timber stands, has a significant bearing on the composition of the resulting stand. Favorable stand composition must be molded early. A decision to favor or discriminate against a species of tree at the first treatment will alter composition of a stand throughout the rotation. This ultimately affects the wildlife food and cover. The method of treatment also has a significant impact upon long-range composition of the overstory and density of the understory. The season and method of site preparation can determine the kind and extent of food and cover produced. Mechanical site preparations in the summer influence wildlife habitat differently then that in the winter. Prescribed burning, or the use of herbicides has various impacts upon the overstory and understory plants depending upon the season. These effects should be considered in the plans to feature various wildlife species in the area. Logging scheduled during spring may adversely affect breeding success for ground nesting birds. Logging during peak hunting periods may create conflicts between loggers and hunters. The season greatly influences the vegetational response, the degree of understory kill, and the type of vegetation with prescribed burning. Prescribed burning must fit a desired range of weather conditions and should not interfere with nesting or brooding activities. The scheduling of flooding and dewatering of greentree reservoirs (bottom land flooded from fall to early spring) is critical because the physiology of the trees and the needs of waterfowl are involved. Water must be off the area during the plant-growing season. Flooding or dewatering should be timed to improve seed catch or the survival of seedlings at regeneration.

The third factor, the sequence of treatments has a definite bearing upon mast (nuts from certain forest trees like acorns, beechnuts, or walnuts) and forage production. It involves the order in which different treatments are imposed on the same stand or area, and the progression of treatments across adjacent stands or areas.

Prescribed burning on the Francis Marion National Forest, South Carolina. FS-9318.

Prescribed burning is an important tool in southern wildlife management. Many areas of this type are burned every 3 to 5 years. Wildlife food plants respond well to fire, particularly leguminous plants. In the west, the use of forest fire is assuming increasing importance as a silvicultural and habitat management tool.

Other techniques of wildlife management deal directly with the wildlife itself. The objective here is also to keep a balance between the numbers of each species and the capability of its range to support it. So, along with maintaining the habitat at its maximum carrying capacity, it is important to regulate the numbers of animals to stay below the point at which there is overcrowding and its resulting damage to the habitat and animal health. Some of the management techniques for wildlife species are consumptive use, stocking, and predator control.

Wildlife populations can be successfully regulated by consumptive use. It is important, however, that professionals conduct surveys and recommend sound hunting regulations. Many species of game, such as whitetailed deer and mourning doves, are more abundant now than when the first settler came to this country. It is worthy to note that when a game species is in short supply, the hunter is not only the first to call for action but he supplies the money (through the purchase of hunting and fishing licenses and sporting equipment) to employ biologists and make sure this species is protected and increased. The game species, both large and small, inhabit forests and grasslands throughout the United States and are studied and protected by State and federal fish and game agencies.

When big game like elk, deer, and antelope, and even small game, like rabbits, overgraze their land, they may also destroy crops and gardens, and consume the food fenced off for sheep and cattle. Game laws not only help the forest habitat by keeping numbers at a constant level, but in so doing, help farmers and ranchers.

Not to be cut--wildlife den tree. Clark National Forest, Missouri. FS-488326

Hollow inside, but still a prolific producer of acorns, this whiteoak tree has been reserved for wildlife food and shelter. As a designated "wildlife tree" it will be protected.

California Department of Fish and game biologist plants 8-inch trout in Pi Pi Creek, Eldorado National Forest, California. FS-511952.

Stocking of a stream with hatchery-raised fish to build up the fish population is a common nationwide practice that improves the fisherman's chances of catching a legal-sized fish. 37

Releasing a fawn in its new home. Chequamegon National Forest, Wisconsin. FS-405653.

Transplanting a deer from an over-populated deer area to an under-populated territory benefits the animals of both areas. It reduces competition for food in the old area and assures ample food in the new one.

Stocking is used to build population numbers both in areas where the species has died out and in areas where the species already exists. Stocking for hunter harvest can be an expensive and high risk operation; few of the hand-raised young can survive in a more difficult environment, and are easy prey for hunters. For this reason, most stocking is done just before hunting season opens providing more game for sportsmen, and therefore, a higher return on the money spent for collecting, feeding, and transporting these game species.

Besides stocking areas with hand-raised animals, wild species are transplanted from one area to another. Although this method is more difficult, animals have a better chance of survival; therefore, this method is usually used to reestablish a species in an area. There are many areas where this method of restocking has been used, and which abound with the species today. The white-tailed deer had almost disappeared from the Mid-Atlantic States shortly after the settlers arrived. Today, the East Coast is carrying more deer then ever because of intensified management and transplanting. Even small game such as quail, grouse, and rabbits have been successfully reintroduced and have, in some cases, reproduced even to the point of overpopulation.

The introduction of exotic animals is also a form of stocking. They can be stocked to provide hunting, to serve as predators in controlling some pest, or simply to add another species to the native wildlife community. Most efforts to establish exotics have failed even with an extensive program effort. The U.S. Fish and Wildlife Service now controls the permitting or barring of imported animals in our country. There have been some successful introductions, like the ring-necked pheasant which was originally introduced into Oregon from Asia. This bird is an important upland game bird throughout the West and Midwest. Some exotics have survived in our country and have been detrimental to our native wildlife species. The English Sparrow and the Eruopean Starling, both aggressive and noisy species, have appropriated the breeding habitat formerly used by the more attractive or melodious native species like the bluebird, purple martin, and red-headed woodpecker. The Indian mongoose was introduced into Puerto Rico to control rats and has become a predator to poultry and ground nesting birds. One of the latest undersirable introductions is the walking catfish which is destructive to marsh habitats in the South. Before an exotic animal is introduced, it is important that its native habitat and its new habitat are studied thoroughly to help prevent harmful introductions.

Predator control, as a form of regulation, is a controversial subject. The crow, has been attacked by irate duck hunters for destroying nests and making a meal of eggs and ducklings. However, it has been found that 2/3 of their diet is composed of beetles, grasshoppers, and other herbivorous insects which are crop-destroying pests. The barn

owl has been despised by both the hunter and the farmer; by the first for supposedly seizing quail and rabbits and by the other for raiding the chicken yard. However, 1.07 percent of the owl's diet are birds; with the majority being starlings and sparrows which are considered pests. Further, over 90 percent of the mammals consumed were primarily the meadow mouse which is quite capable of inflicting serious crop damage.

Most ecologists consider the predator as forming an essential part of the ecosystem. In a predator food chain, the producers which get their energy from the sun, are in the greatest numbers, the herbivores, which obtain energy from the plants, have less numbers, and carnivores, which feed on herbivores, have the least numbers. The number of

Chinese pheasant (male), Oregon. FS-226449.

Native of Asia and introduced into the United States long ago. The Chinese ring-necked pheasant has thrived and has become an important upland game bird in the West and Midwest.

predators in the top of a food pyramid is dependent on the number of prey animals, not the reverse. In some cases, paradoxical as it may seem, predators may actually promote the welfare of the prey species by culling the aged, crippled, and diseased individuals from the population. Also, predators may serve a useful role in keeping the resilient prey population within the limits imposed by the carrying capacity of its habitat. A lack of predatory pressure might release

Bobcat, a carnivores predator, Coronado National Forest, Arizona.
FS-184853

It's when a predator preys on domestic livestock or causes a precipitous decline in the population of desired wildlife that the question of controlling the predator becomes a pressing one.

a population explosion resulting in habitat deterioration and culminating in massive death by starvation and disease. However, there are situations where predator control is needed to protect endangered wildlife species or domestic livestock.

Non-game species, though not so intensively managed, form an integral part of a forest and contribute substantially to the enjoyment of the forest visitor. They also play an important role in the ecology of the forest.

The management for threatened and endangered species has been a part of the job of the Forest Service for many years. These species occur all over the United States and in Puerto Rico. Saving endangered species nationwide has to be a cooperative job involving many federal and State agencies, National, State, and local conservation groups, and individuals.

Destruction of habitat and the encroachment of man has been the biggest factor leading to the decline in numbers of threatened and endangered species. Of the 109 species of wildlife on the endangered list, 39 are on or near National Forests.

Wildlife refuges may be placed in three categories: (1) those designed primarily to accommodate waterfowl; (2) those designed to serve big game animals such as mountain goat, antelope, and deer; and (3) those designed to save endangered species from possible extinction. Within these refuges, the wildlife is free from hunting to allow a build-up in its populations. Aside from saving the habitat from human development, specialists have studied the endangered species and their habitat requirements making a regular inventory of nests and breeding sights, and using direct habitat improvement where needed.

Wildlife can be destructive to other interests of the forest habitat. Deer may inhibit the growth of trees by eating the seedlings. Mice and rabbits eat bark off young trees at the gound level in winter. Beaver will fall aspen and popular tree stands, although they use very little of the wood. Porcupines girdle trees by eating off the bark. Large cats and bears will scratch a tree causing scars and other damage. However, nature has built-in controls, a check and balance system to preserve her creatures and also to preserve the habitat.

Wildlife themselves are economically important to other fields. Birds will help control insect pests. Predators can help control mice, rabbits, crows, starlings, and other pests, benefiting farmers and ranchers.

Wildlife is a very important resource both commercially and

Signing a game refuge, cooperatively managed by the State of Ohio and the U.S. Forest Service, Wayne National Forest, Ohio. FS-401632

Within game refuges, wildlife is free from hunting allowing it to build up its population. Refuges may be designed to serve waterfowl, big game, or to save an endangered species from possible extinction.

esthetically. Billions of dollars are spent annually by hunters, photographers, and other outdoor lovers on equipment and travel to participate in wildlife activities. Considerable amount of money is generated from special animals products, like doe skin moccasins, mink and rabbit fur coats, and smoked salmon. Hunters and fishermen pay for operations of all 50 State fish and game agencies through sales of hunting and fishing licenses. The money for support of these agencies does not ordinarly come from general revenue channels. In fact, hunting and fishing are unique among most outdoor recreational activities in that the participants directly pay for the support and increase of their sport. It should also be pointed out that without this direct support, most game management programs would be in serious condition.

Research is also important to wildlife management. Numerous agencies of Federal, State, and local governments plus industry and private citizens use the information and methods generated by research to improve their policies and practices. Research must cover a full

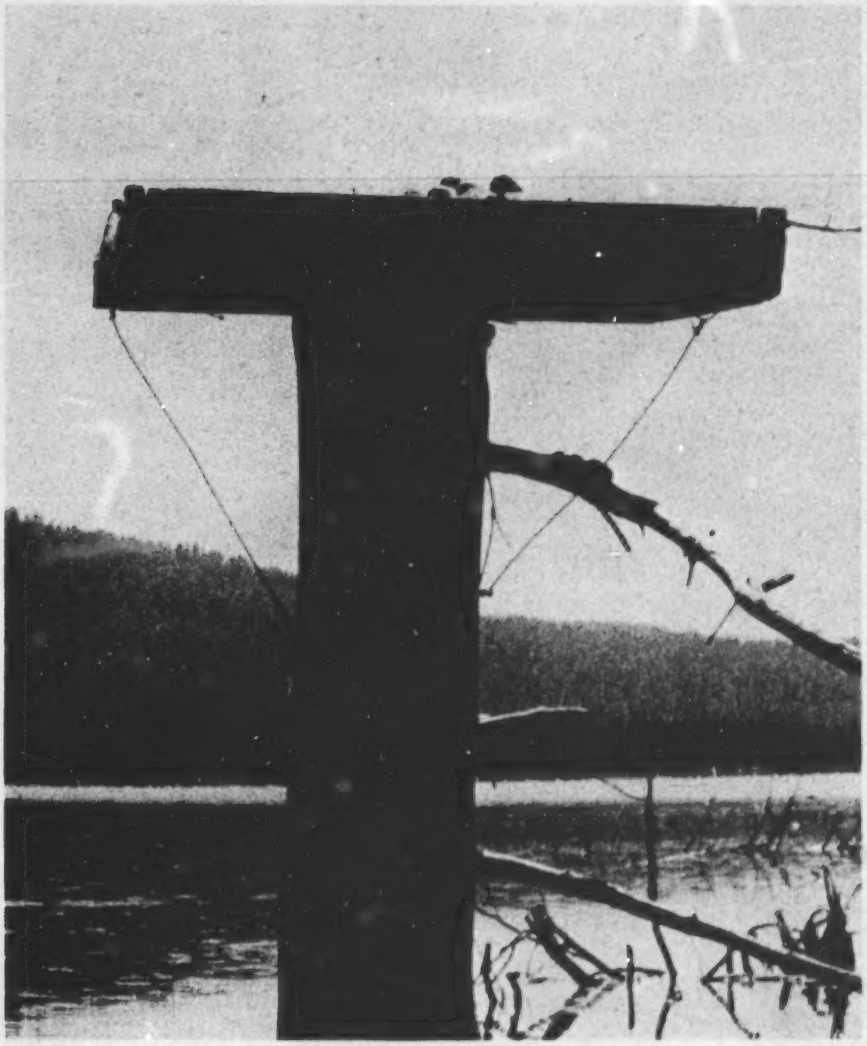
spectrum of disciplines in the biological, physical, economic, and social sciences to solve complex problems concerning forest and related ecosystems and their interfaces with urban areas.

The production of timber, grazing of livestock, and water use can have a great impact on the value of a habitat that is also planned for wildlife. In order to reconcile such a possible conflict, the wildlife habitat resource specialist needs to define the particular requirements of the species of wildlife, develop the technology necessary to meet these requirements, and evaluate the impact of other land uses on the environment.

Wildlife habitat research by the Forest Service is a continuing long-term program of both applied and basic research. At 15 locations throughout the United States, studies are conducted with various

Six legally taken sharptail grouse. Wisconsin. FS-386327

Like these two hunters, good sportsmen carefully observe the legal bag limits. Billions of dollars annually are spent by hunters and fishermen in the pursuit of their sports. State hunting and fishing license fees pay for fish and wildlife improvement and protection programs throughout the Nation.



Goose nesting platforms, Deschutes National Forest, Oregon.
FS-2969-12

Researching and testing ways to improve wildlife habitat management is one continuing activity of Forest Service scientists. These nesting platforms at Crane Prairie Reservoir were not accepted immediately. It was 4 years before the geese chose to nest in them.

State and Federal agencies, and, in some instances, with industry and private sportsmen's associations. Wildlife biologists usually work together with a team referred to as a "Research Work Unit." At times, the Unit is composed entirely of wildlife biologists, but quite often a team of scientists specializing in various disciplines is needed to solve the complex problems encountered in the management of lands for multiple uses--including wildlife.

WHAT OF THE FUTURE?

The purpose of managing our forests now is to provide future generations with the same, and maybe more, forest products and the same opportunity to enjoy the solitude and the grandeur of the forest lands. Nature has an incredible ability to heal, until the soil is completely degraded, and maybe even then some plants and animals will grow and regenerate themselves. Nature is doing its part; our duty is to be conscientious in our use of the forest and its resources. In the past, the forest land and products were exploited; sometimes used wastefully and with little thought for the future. But now, through the multiple use-sustained yield system, the coordinated management of the five forest resources, we can be assured of a continued array of resources on lands administered by the Forest Service, one of which, of course, is wildlife.

DID YOU KNOW

1. Did you know that not only some species of salmon, but striped bass, char, cisco, shad, alewife and sea lamprey are anadromous? (Live in salt but breed in fresh water.)

2. Did you know that some species of fish are catadromous? (Live in fresh but breed in salt water.)

3. Did you know that some species of bass have both male and female organs?

4. Did you know that full grown bluefin tuna can weigh over 1500 lbs?

5. Did you know that there are only approximately 50 California Condors in the whole world today?

6. Did you know that a salmon can jump over 8 feet high?

7. Did you know that a road runner can run 15 mph?

8. Did you know that a whale is a mammal and suckles its young?

9. Did you know that a rattlesnake's rattle is made of interlocking hollow rings of hardened skin?

10. Did you know that rodents teeth never stop growing?

11. Did you know that all deer species drop their antlers in late winter?

12. Did you know that mice can get their needed calcium from deer antlers?

13. Did you know that it takes 4 months for a pronghorn's horn to grow back from the bony remnant after shedding?

14. Did you know that a golden eagle is 3 months old before it learns to fly?

15. Did you know that a mountain goat has concave hoofs that act as suction cups to help them balance on small ledges and steep cliffs where they live?

16. Did you know that both deer and rabbits will eat meat at times?

17. Did you know that the northern weasels coat will change from brown to white with the seasons?

18. Did you know that at times coyotes and badgers work together to catch prey?

19. Did you know that most mammals are colorblind?

20. Did you know that mountain lions may have a home range of 30-50 miles?

21. Did you know that a beaver can bring down a 4-inch aspen or poplar in 15 minutes?

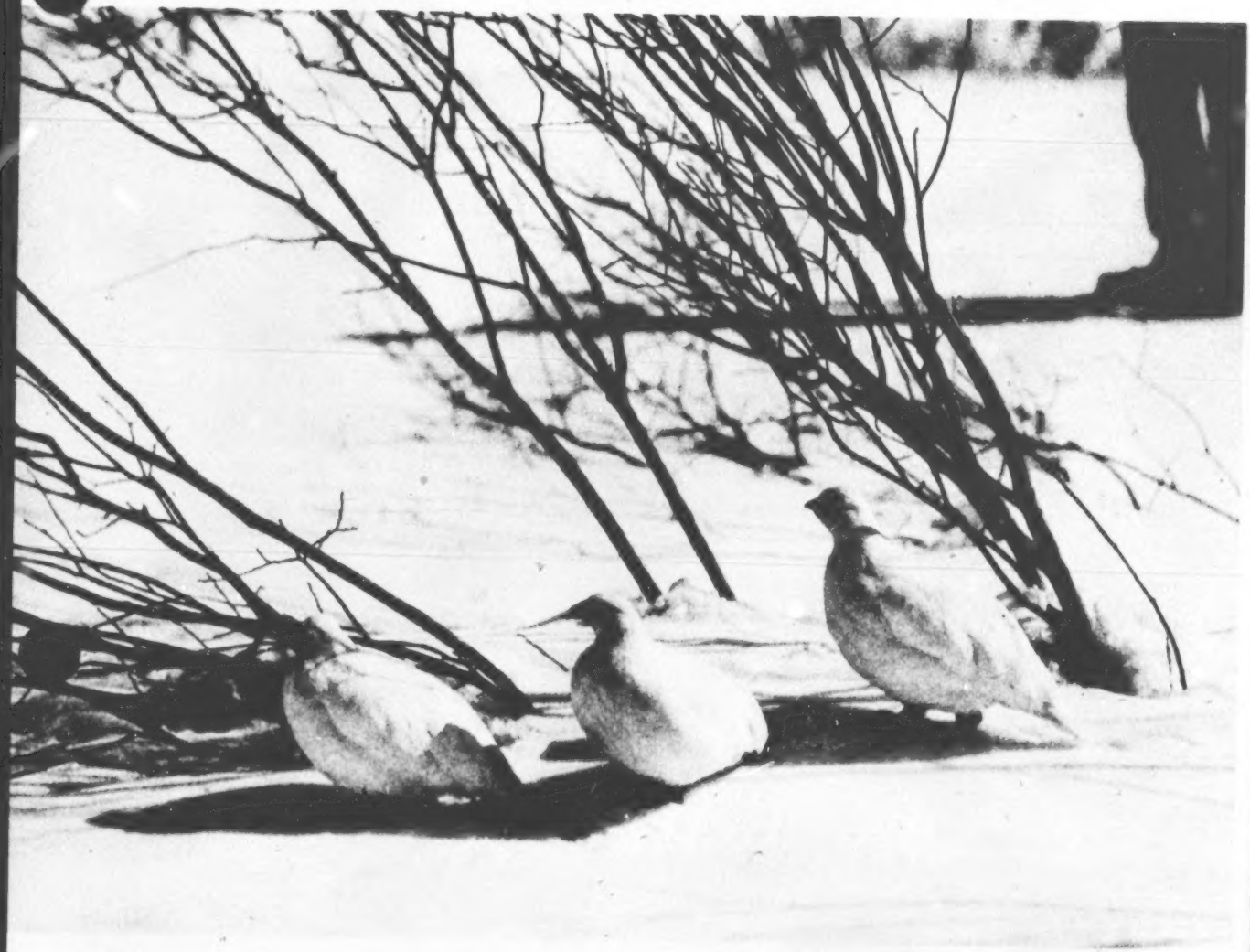
22. Did you know that besides building dams beavers also build canals?

23. Did you know that it takes 14 newborn possums to weight 1 oz?

24. Did you know that a hawk can see 4-8 times better then a man?

25. Did you know that a woodcock can see 360° without turning its head?

26. Did you know that hummingbirds can fly forward, backward, straight-up, and hover motionless?



White-tailed ptarmigan, Gunnison National Forest, Colorado. FS-233623

Did you know that birds like these white-tailed ptarmigans fluff out their feathers as insulation against cold? Note the protective coloring of these birds in their winter environment.

27. Did you know that all birds have three eyelids?

28. Did you know that a typical sparrow hawk will eat 290 mice in 1 year?

29. Did you know that a woodpecker taps a song instead of singing?

30. Did you know that a whooping crane is 5 feet tall?

31. Did you know that a reptile regulates its temperature by seeking either warm or shady spots?

32. Did you know that the water ouzel, a wren size bird, walks on the bottom of fast flowing streams? Its oil gland is ten times the size of a wren. The ouzel is also known as the "dipper."

33. Did you know that a grey fox can climb trees?

34. Did you know that a bird will fluff out its feathers as an insulation to cold?

35. A fish will survive being caught in a frozen pool, if its body is not frozen solid.

36. Did you know that a raccoon is a carnivore?

37. Did you know that a squirrel's home range is 2-8 acres?

38. Did you know that a squirrel reproduces 2 1/2 times better in a tree then a nest?

39. Did you know that a bird produces less eggs if it doesn't have enough water?

40. Did you know that a snake cannot close its eyes?

41. Did you know that 33% of the land in the U.S. is forested land?

42. Did you know that a squirrel needs at least 1 1/2 lbs. of nuts a week, along with berries and seeds?

43. Did you know that a quail has a range of 40 acres?

44. Did you know that a white-tailed deer needs 6-8 lbs. of green food daily for every 100 lbs. of weight?

45. Did you know that a white-tailed deer's range may be 300 acres?

46. Did you know that deer like burned over land?

47. Did you know that a turkey's home range is 1 square mile?

48. Did you know that a grizzly in Alaska hibernates for 5 months?

49. Did you know that an oak must grow 25 years before producing a good crop of nuts?

50. Did you know that a strip-cropped field attracts about twice as many ground nesting birds as fields not strip-cropped?

51. Did you know that the white-tailed deer is more abundant now then in the year 1600?

52. Did you know that unspoiled tidal marshes rank above the best prairie croplands in economic productivity?

53. Did you know that a California condor can weight 20 lbs. and attain a wingspread of over 9 feet?

54. Did you know that a mallard duck can eat between 1 and 2 lbs. of grain a week?

55. Did you know that ducks 8-9 weeks old eat 44% more then the adults?

56. Did you know that trout can't live for a period of time in water temperatures over 70°?

57. Did you know that fingerling trout are sometimes stocked from the air?

58. Did you know that seals will make a parasol of their flippers to protect themselves from the sun?

59. Did you know that the crossbill is so specialized that it can survive only in coniferous forests?

60. Did you know that the mourning dove can be found in any State in the continental U.S.?

61. Did you know that pronghorn antelope warn their fellows of danger by flashing the white hair growing on their rump?

62. Did you know that no large animals are permanent residents in caves?

63. Did you know that bobwhite quail sleep together in a circle, like the old wagon trains, with heads out and tails together?

64. Did you know that a golden eagle can live up to 80 years?

65. Did you know that the U.S. has three species of elk; the tule elk, Rocky Mountain elk, and the Roosevelt elk?

66. Did you know that a mountain lion usually eats three deer a month?

67. Did you know that a badger can dig itself out of sight in under 5 minutes?

Buck and 6 doe antelope in their natural habitat. Gallatin National Forest, Montana. FS-448136

Pronghorn antelope warn their fellows of danger by flashing the white hair growing on their rumps.

68. Did you know that rabbits will run in a wide circle when chased?

69. Did you know that a porcupine has 20,000 quills?

70. Did you know that most of the species of salmon do not eat when they run up river and die after they spawn?

71. Did you know that pound for pound the great horned owl is one of the most powerful birds of prey in the world?

72. Did you know that a bald eagle's nest is more than 5 feet across and 10 feet deep?

73. Did you know that opossums are the only marsupials in North America?

74. Did you know that bears are the largest living land carnivores?

75. Did you know that all American cats have retractile claws?

76. Did you know that all deer have white patches on the rump which are displayed while running to alert the herd?

77. Did you know that tree frogs can change color?

78. Did you know that in winter, hair-like projections form on ruffed grouse's feet giving a snow shoe effect?

79. Did you know that the white footed mouse can swim and climb trees?

80. Did you know that a bat is a mammal; the only one that flies?

81. Did you know that a "flying" squirrel can glide up to 120 feet?

82. Did you know that both male and female caribou have antlers?

83. Did you know that the white-tailed ptarmigan changes color. In summer it is brown with a white belly, white wings and tail. In winter it is all pure white except for black eyes and bill.

Striped skunk, Monongahela National Forest, West Virginia. FS-518343

All living creatures of the forest have a rightful place in its environment--even the skunk.

## SUGGESTED ADDITIONAL READING


1. KYLIE, H. R., HIERONYMUS, G. H., AND HALL, A. G. 1957. CCC Forestry, United States Government Printing Office, Washington.

2. WOLF, DONALD H., Division of I&E. Wildlife for Tomorrow. FS-USDA.

3. FOREST SERVICE HANDBOOK 2609.23R. Wildlife Habitat Management Handbook, Southern Region, FS-USDA.

4. WILDLIFE HABITAT IMPROVEMENT HANDBOOK, FS-USDA. 1968.

5. RANGE AND WILDLIFE HABITAT EVALUATION: A RESEARCH SYMPOSIUM. FS-USDA/Miscellaneous Publication 1147.

6. SYMPOSIUM: INTRODUCTION OF EXOTIC ANIMALS: ECOLOGICAL AND SOCIOECONIMIC CONSIDERATIONS. Kleberg Research Program in Wildlife Ecology, College of Ag., Texas A&M University.

7. HALLS, LOWELL K., STRANSKY, JOHN J. Atlas of Southern Forest Game. Southern Forest Experiment Station, FS-USDA. 1971.

8. MORE WILDLIFE THROUGH SOIL & WATER CONSERVATION. Ag I Bulletin #175, SCS-USDA.

9. MANAGING WOODLANDS FOR WILDLIFE, FS-USDA, Northeastern Area S&PF.

10. WILDLIFE, THE ENVIRONMENTAL BAROMETER. Wildlife Management Institute, 709 Wire Building, Washington, D.C. 20005.

11. BUILDING A POND, SCS-USDA, Farmers Bulletin No. 2256, 1973.

12. SHOMON, JOSEPH J. Wildlife Habitat Improvement. National Audubon Society Nature Centers Division, 1966.

13. CALIFORNIA CONDOR/CALIFORNIA WILDLIFE INFORMATION SHEET. The Resources Agency of California, Dept. of Fish & Game, 1966.

14. WILDLIFE HABITAT ON THE CLARK & MARK TWAIN NATIONAL FORESTS, Missouri . . . A program . . . USFS-USDA in cooperation with Missouri Dept. of Conservation.

ABOUT THE FOREST SERVICE. . . . .

As our Nation grows, people expect and need more from their forests--more wood; more water, fish and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:

Conducting forest and range research at over 75 U.S. locations, including Puerto Rico, Alaska, and Hawaii.

Participating with all 50 State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.

Managing, protecting, and directing the use of the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple-use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the Country's forest resources.

For 70 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.